NON-PUBLIC?: N
ACCESSION #: 9012110224
LICENSEE EVENT REPORT (LER)

FACILITY NAME: HOPE CREEK GENERATING STATION PAGE: 1 OF 8

DOCKET NUMBER: 05000354

TITLE: REACTOR SCRAM ON HIGH AVERAGE POWER RANGE MONITOR FLUX LEVELS DUE
TO BROKEN PRIMARY CONTAINMENT INSTRUMENT GAS LINE
EVENT DATE: 11/04/90 LER #: 90-024-00 REPORT DATE: 12/03/90

OTHER FACILITIES INVOLVED: DOCKET NO: 05000

OPERATING MODE: 1 POWER LEVEL: 100

THIS REPORT IS SUBMITTED PURSUANT TO THE REQUIREMENTS OF 10 CFR SECTION:
50.73(a)(2)(iv)

LICENSEE CONTACT FOR THIS LER:
NAME: Robin Ritzman, Engineer - Technical TELEPHONE: (609) 339-3737

COMPONENT FAILURE DESCRIPTION:
CAUSE: B SYSTEM: LD COMPONENT: PSF MANUFACTURER:
REPORTABLE NPRDS: N

SUPPLEMENTAL REPORT EXPECTED: NO

ABSTRACT:

On 11/4/90 at 0042, a Reactor Scram occurred due to Average Power Range Monitor (APRM) Fixed Neutron Flux Upscale (118% Power), which was initiated by closure of the B Inboard Main Steam Isolation Valve (MSIV). The B MSIV closure resulted from failed fitting on a Primary Containment Instrument Gas (PCIG) Supply Line to the MSIV, causing it to close. The Reactor Protection System functioned normally to shut down the Reactor. A second Scram signal occurred on low level (12.5") in the Reactor Vessel when a Nuclear Control Operator (NCO, RO licensed) placed the C Feedpump in the positioner mode, and did not adequately monitor Reactor vessel water level. Also, during the course of recovery from the scram, the Condenser Mechanical Vacuum Pumps were started to maintain vacuum in the Main Condenser due to unavailability of the Steam Seal System. This system alignment resulted in Condenser gas being released via the South Plant Vent (SPV) without the normal offgas treatment (no holdup time),

and initiated an SPV Radiation Alarm.

Corrective Actions include performing design enhancements on the Inboard MSIV piping, evaluating further potential design changes for this piping configuration, repairing defective equipment, procedural enhancements, additional administrative guidance, licensed operator training on this event, and counselling for the NCO involved in the second Scram.

END OF ABSTRACT

PLANT AND SYSTEM IDENTIFICATION

General Electric - Boiling Water Reactor (BWR/4)
Primary Containment Instrument Gas (EIIS Designation: LD)
Main Steam (EIIS Designation: SB)
Reac
or Protection (EIIS Designation: JC)
Neutron Monitoring (EIIS Designation: IG)
Control Rod Drive (EIIS Designation: AA)
Feedwater (EIIS Designation: SJ)
Condensate (EIIS Designation: SD)
Main Turbine Sealing Steam (EIIS Designation: TC)
Gaseous Radwaste (Offgas) (EIIS Designation: WF)

IDENTIFICATION OF OCCURRENCE

Reactor Scram on High Average Power Range Monitor Flux Levels
due to Broken Primary Containment Instrument Gas Line

Event Date: 11/4/90
Event Time: 0042
This LER was initiated by Incident Report No. 90-146

CONDITIONS PRIOR TO OCCURRENCE

Plant in OPERATIONAL CONDITION 1 (Power Operation), Reactor power 100%, unit load 1098 Mwe.

DESCRIPTION OF OCCURRENCE

On 11/4/90 at 0042, a Reactor Scram occurred as a result of the closure of the B Inboard Main Steam Isolation Valve (MSIV). The closure of the MSIV caused an increase in Reactor pressure and a reduction in voids resulting in an increased neutron flux, which in turn caused the Scram on

Average Power Range Monitor (APRM) Fixed Neutron Flux Upscale (118% power). The Reactor Protection System (RPS) functioned normally to shut down the Reactor.

Upon receipt of the valid Scram signal, the Scram Discharge Volume (SDV) Vent and Drain Valves functioned normally to the closed position. When the Scram was reset, the valves did not open in an appropriate time. This malfunction was due to a broken air regulator which supplies the motive force for opening these valves. The purpose of these valves, to isolate upon receipt of a Scram signal, was not affected by this malfunction.

DESCRIPTION OF OCCURRENCE, CONT'D

The Steam Sealing System did not automatically swap to a backup source of steam following the Scram due to a controls malfunction. Following a Reactor Scram, the source of steam to the Steam Seal Evaporator should automatically swap from its normal source of Extraction Steam to Main Steam. This failure to swap to Main Steam caused a decrease in Main Condenser vacuum, prompting the Nuclear Control Operator (NCO, RO licensed) to place the Mechanical Vacuum Pumps in service in response to the decreasing vacuum. An Equipment Operator (EO, non-licensed) was dispatched to the local control panel for the Steam Sealing System and was able to manually operate the valves and restore the Steam Seal System to service.

Additionally, all plant systems responded as expected, with the following exceptions:

1. The Feedwater Heating System received an isolation signal to the #1, #2, and Drain Cooler Feedwater Heaters

2. Two of the required Main Steam Line Drain Valves did not open as required

3. The B Secondary Condensate Pump Minimum Flow Valve failed to open in a sufficient time when flow through the pump decreased to the setpoint and tripped when flow through the pump decreased to less than the setpoint.

4. The F Intermediate Range Monitor (IRM) failed to insert into the Core following the Reactor Scram.

During recovery from the Scram, the NCO attempted to restore level using

the positioner mode of the Feedwater System. Level control problems were experienced while attempting to restore Vessel level and a second Scram occurred at 0103 as a result of Reactor level decreasing below the RPS low level setpoint of 12.5". The operating mode of the Feedwater System was changed, the level was restored to the normal operating band, and the Scram was reset.

At 0106, a plant cooldown was initiated using the Main Condenser as a heat sink in accordance with plant operating procedures. At approximately 0118, a South Plant Vent (SPV) Radiation Alarm was received in the Main Control Room due to the placing of the Mechanical Vacuum Pumps into service.

After plant conditions stabilized, a four hour non-emergency report was initiated in accordance with 10CFR50.72 due to the automatic actuation of the RPS.

ANALYSIS OF OCCURRENCE

There are four separate events that will be discussed in section. They this are the Primary Containment Instrument Gas (PCIG) Line Break, the APRM the Low Reactor Level Scram, Fixed Neutron Flux Upscale Scram, and the SPV Radiation Alarm.

PCIG Line Break

A threaded fitting on the PCIG Supply Line to the B Inboard MSIV Pilot Actuator failed, causing the MSIV to close. The closure of the B MSIV caused an increase in Reactor Pressure and a reduction in voids resulting in a Reactor Scram on High Neutron Flux. Refer to Attachment 1 for a depiction of the PCIG line and associated fitting.

APRM Fixed Neutron Flux Upscale Scram

The RPS initiated a Reactor Scram signal when High Neutron Flux was detected above the trip setpoint for the A, B, and F APRM's. The C, D, and E APRM's setpoints were not exceeded; therefore, the RPS inputs from these APRM's were not received. The RPS APRM Technical Specification setpoint range for High Neutron Flux is between 116.2% and 118%. Setpoint verification following the scram determined that the actual setpoints of the APRM's were as follows:

APRM A B C D E F

SET
POINT 117.45 117.30 117.70 117.74 117.73 117.71

The Gain Adjustment Factor (GAF) of the APRM's were as follows:

.994 .999 1.000 1.001 .999 .997

The power levels at which each APRM tripped (setpoint x GAF):

116.7 117.2 117.7 117.9 117.6 117.3

In summary, the APRM trip setpoints were set below the Technical Specification limit of 118%. The above data indicated that all APRMs functioned as designed.

ANALYSIS OF OCCURRENCE, CONT'D

Low Reactor Level Scram

Following the Reactor Scram, indicated Reactor Vessel level decreased due to void collapse. The Feedwater Control System responded to the low level by maximizing feedpump output and flow to the Reactor Vessel. The NCO placed the C Feedpump in the positioner mode to prevent a Feedpump Turbine trip which would occur when Reactor Vessel level reaches +54". In the positioner mode, the Feedpump will not respond when changes in speed or flow occur as Reactor pressure or level change.

The initial source of steam used to drive the Feedpump was the residual steam in the Moisture Separators. As this supply depleted, the feedpump speed and flow was lowered, reducing feed flow to the Reactor Vessel. The NCO also began a cooldown using the Turbine Bypass Valves which removed Vessel inventory at a faster rate than when the Feedpump was placed in service. These two conditions resulted in Reactor Vessel decreasing at a faster rate than the NCO anticipated, resulting in a second Reactor Scram, this one on low level.

South Plant Vent (SPV) Radiation Alarm

The Condenser Mechanical Vacuum Pumps, which were started to maintain vacuum, allowed the condenser gas to be released via the SPV without the normal offgas treatment. This release was exacerbated by the Reactor Scram and a higher than normal Reactor Coolant Iodine activity level due to a suspected fuel pin leak.

At 0118 the Radiation Monitoring System (RMS) indicated a high alarm from the SPV Noble Gas Monitor (high gas concentration) followed by a high SPV effluent alarm (release rate). The Event Classification Guide (ECG) Section 7.E states that an Unusual Event (UE) should be declared if a release has exceeded or is expected to exceed the Emergency Action Level (EAL) limits for greater than or equal to 15 minutes. The Senior Nuclear Shift Supervisor (SNSS, SRO Licensed) determined, based on instantaneous release data, that the SPV Gas Monitor reading fluctuated around 1.2E4 microcurie/sec, but did not exceed EAL limits for 15 sequential minutes. Therefore, declaration of a UE was not warranted. A post-release analysis of RMS data indicates that for clarity and ease of use, the EAL should be based on average data rather than instantaneous data.

APPARENT CAUSE OF OCCURRENCE

PCIG Line Break

The PCIG fitting that failed is a pipe nipple that threads into the solenoid manifold block, and is then welded to a PCIG line elbow. The nipple failed at the threaded connection. Subsequent to the scram, the nipple was sent to Lehigh Testing for analysis. This analysis indicated that the pipe nipple was not adequately threaded into the solenoid manifold block during installation. Two other factors contributed to the failure of the nipple: 1) vibration during normal plant operation and 2) tensile residual stresses induced on the threaded connection when welding the opposite end of the nipple to its connecting PCIG line elbow during installation.

APRM Fixed Neutron Flux Upscale Scram

The initiating cause for the first Scram was the failure of the PCIG pilot supply line to the solenoid manifold block of the B MSIV. This started the closure of the B MSIV, as designed, and caused a Reactor Scram on high APRM flux levels.

Low Reactor Level Scram

The initiating cause of the second Scram was low level in the Reactor Vessel. The root cause was a personnel error when the NCO placed the Feedpump in the positioner mode and did not adequately monitor Reactor vessel water level.

South Plant Vent Radiation Alarm

The initiating cause of the SPV Radiation alarm was increasing radiation levels due to placing the Condenser Mechanical Vacuum Pumps in service to maintain condenser vacuum following a Reactor Scram with a suspected pin hole leak. These pumps were placed in service because the Turbine Sealing System was not able to maintain Main Turbine Shaft Seals. The root cause was the failure of the Steam Seal Evaporator to automatically swap from Extraction Steam to Main Steam.

PLANT TRANSIENT RESPONSE

All plant systems responded as expected with the exception of the system responses noted in the "Description of Occurrence". With respect to these exceptions, the post scram analysis determined the following:

PLANT TRANSIENT RESPONSE CONT'D

1. The Feedwater Heating System received an isolation signal to the #1, #2, and Drain Cooler Feedwater Heaters. This occurred due to level instrument fluctuations (rapid instrumentation response to level transients). An engineering evaluation of the feedwater heater instrument response is being conducted.

2. Two of the required Main Steam Line Drain Valves did not open as required due to a controls malfunction. These valves were repaired prior to plant restart.

3. The B Secondary Condensate Pump Minimum Flow Valve (MFV) failed to open in a sufficient time when flow through the pump decreased to the MFV setpoint. This resulted in a trip of the B Secondary Condensate Pump. Followup investigation determined that the MFV did not open due to slow valve stroking time and a defective controller card. These items were repaired prior to plant restart.

4. The F Intermediate Range Monitor (IRM) failed to insert into the core following the Reactor Scram. The IRM drive gearbox was repaired prior to plant restart.

PREVIOUS OCCURRENCES

There have been no previous occurrences of PCIG line failure, MSIV closure Scrams, or increased offsite dose releases through offgas (SPV or North Plant Vent). LER 86-035 describes an APRM Scram due to a momentary upscale spike of an undetermined cause.

SAFETY SIGNIFICANCE

The potential safety impact of the Scrams discussed in this report was minimal, as a plant Scram is an analyzed event and, with the previously noted exceptions, all systems responded as expected. None of the abnormal system responses posed a threat to the ability to achieve and maintain safe shutdown conditions. These Scrams posed no threat to the health and safety of the general public.

The Hope Creek ECG limit for gaseous radiological releases is half of the Technical Specification allowable release rate for the Hope Creek/Salem Nuclear site. During the time that the release rate fluctuated near the EAL release limit, Salem did not have any releases in progress. Therefore, the Condenser gas release posed no threat to the health and safety of the general public.

CORRECTIVE ACTIONS

1. A design change was implemented on all inboard MSIV PCIG supply lines. This design change encompassed installation of new unions, elimination of flanges and replacement with unions/couplings, and replacing the PCIG pipe nipples with schedule 80 -vs- schedule 40 nipples. The outboard MSIVS utilize flexible hoses for PCIG supply, and therefore, were determined to be satisfactory as installed.

2. A design change request is being submitted to evaluate additional improvements to the inboard MSIV PCIG supply lines.

3. The ECG will be revised to clarify the interpretation of RMS data.

4. The Steam Seal Evaporator Controls and the Main Steam Line Drain Controls were repaired.

5. The NCO who placed the Feedpump in the positioner mode and did not adequately monitor the Reactor level was counselled with regard to his actions which led to the second Scram.

6. This report will be forwarded to the Nuclear Training Department for inclusion in the licensed operator requalification programs.

7. The maintenance procedure used to remove and install MSIV

Operators will be revised to add a technique that will allow indication of adequate thread engagement of the pipe nipple into the solenoid manifold block.

8. The scram discharge vent and drain valves air regulator was repaired.

Sincerely,

J. J. Hagan
General Manger -
Hope Creek Operations

SORC Mtg. 90-110

ATTACHMENT 1 TO 9012110224 PAGE 1 OF 2

Figure "Attachment 1; MSIV Pilot Actuator PCIG Supply Schematic" omitted.

ATTACHMENT 1 TO 9012110224 PAGE 2 OF 2

PSE&G

Public Service Electric and Gas Company
P. O. Box 236
Hancocks Bridge, New Jersey 08038

Hope Creek Generating Station

December 3, 1990

U. S. Nuclear Regulatory Commission
Document Control Desk
Washington, DC 20555

Dear Sir:

HOPE CREEK GENERATING STATION
DOCKET NO. 50-354
UNIT NO. 1
LICENSEE EVENT REPORT 90-024-00

This Licensee Event Report is being submitted pursuant to the requirements of 10CFR50.73(a)(2)(iv).

Sincerely,

J. J. Hagan
General Manager -
Hope Creek Operations

RAR/

Attachment
SORC Mtg. 90-110

C Distribution

*** END OF DOCUMENT ***